

Remarks

The replacement paragraph at page 1, lines 5-16 of the specification that was included in the Amendment filed May 24, 2002 is amended to correct a patent and an application serial number and provide the number of a recently issued patent. A marked up copy of the specification is attached.

Claims 1-20 have been finally rejected under 35 U.S.C. §103(a) as being unpatentable over Hartley et al., U.S. Patent No. 4,853,737 ("Hartley"), and incorporated by reference, Lentz, U.S. Patent No. 4,257,699 ("Lentz"), in view of Schlueter, Jr. et al., U.S. Patent No. 5,995,796 ("Schlueter"). Also, claims 1-22 have been finally rejected under 35 U.S.C. §103(a) as being unpatentable over Hartley in view of Schlueter and Blong et al., U.S. Patent No. 5,527,858 ("Blong"). These rejections are respectfully traversed.

For a description of the various types of fluororesins, the attention of the Examiner is respectfully directed to the following excerpt from the background sections of Application Serial No. 09/609,562, now U.S. Patent No. 6,372,833, and Application Serial No. 09/608,289, now U.S. Patent No. 6,416,819, both of which are cross-referenced in the instant application:

Fluororesins, including both fluorocarbon elastomers and fluorocarbon thermoplastics, are widely used in the form of sheet, film, coatings and laminates in various fields due to their characteristic properties such as good heat resistance, good chemical resistance and good weather resistance....

Polyfluorocarbon elastomers, such as vinylidene fluoride-hexafluoropropylene copolymers, are tough, wear resistant and flexible elastomers that have excellent high temperature resistance, but relatively high surface energies, which compromise applications where release properties are critical, for example as release layers on compression molds or outer layers on electrophotographic toner fuser members.

Fluorocarbon resins like polytetrafluoroethylene (PTFE) or fluorinated ethylenepropylene (FEP) are fluorocarbon thermoplastics which have excellent release characteristics due to very low surface energy. Fluorocarbon thermoplastic resins are, however, less flexible and elastic than fluorocarbon elastomers and often require high temperature curing for long time periods to sinter the polymer into a continuous and useful layer or sheet.

Both fluorocarbon elastomers and fluorocarbon thermoplastics have been used to prepare high temperature resistant surfaces.

The Examiner's attention is also respectfully directed to the "References Cited" section of each of these patents, which includes under "Other Publications" two items from the *Encyclopedia of Polymer Science and Engineering*, as follows:

Vol. 17, pp 829-835 on "Thermoplastics and Fluoroplastics"

Vol. 7, pp 257-269 on "Fluorocarbon Elastomers"

These separate entries in the *Encyclopedia* provide clear evidence that fluoroelastomers and fluorocarbon thermoplastic polymers are distinctly different materials. The dissimilarity in properties of these two types of fluororesins is illustrated by the disclosure of Hartley, at column 2, lines 58-63, that commercially available fluoroelastomers generally have glass transition temperatures in the range of about 0°C to about 10°C, in contrast to the teaching of Blong, at column 3, lines 9-16, that a series of THV Fluoroplastics have melting ranges of 115-125°C, 150-160°C, and 165-180°C.

One application for which both fluoroelastomers and fluorocarbon thermoplastic polymers have found use is the formation of the surface release layer of a toner fuser roll. As discussed at page 3, lines 17-25, of the instant specification, each of these types of fluorocarbon resins have both advantages and disadvantages as toner release materials:

Polyfluorocarbon elastomers, such as vinylidene fluoride-hexafluoropropylene copolymers, are tough, wear resistant and flexible elastomers that have excellent high temperature resistance, but relatively high surface energies, which compromises toner release.

Fluorocarbon resins like polytetrafluoroethylene (PTFE) or fluorinated ethylenepropylene (FEP) are fluorocarbon plastics which have excellent release characteristics due to very low surface energy. Fluorocarbon resins are, however, less flexible and elastic than fluorocarbon elastomers and are therefore not suitable alone as the surface of the fuser roller.

As further taught at page 7, lines 17-25, of the specification, the inadequate mechanical strength and toner release properties of fluorocarbon thermoplastic random polymers used alone are, in accordance with the present invention, improved by the inclusion of zinc oxide filler and an aminosiloxane polymer. In addition, the further inclusion of antimony tin oxide particles in the release layer coating composition results in a surprising significant reduction in the temperature required for curing.

Hartley, Lentz, and Schlueter all teach fuser rolls containing release layers formed from cured fluoroelastomers, in particular, VITON™ elastomers, which are commercial materials from duPont. Such materials are characterized by relatively high surface energies, causing them to have less than optimum toner release properties that results in undesirable offset of the toner onto the fuser roll.

Blong teaches thermoplastic fluoropolymer compositions intended for melt-processing, for example, extrusion. The disclosed compositions include a

thermoplastic fluoropolymer such as 3M THV 500 Fluoroplastic in combination with a poly(oxyethylene) hydrogen polymer. The inclusion of this latter component is for the purpose of lowering the melt temperature of the composition to facilitate its extrusion. Although the compositions of Blong, in contrast to those of Hartley, Lentz and Schlueter, do include thermoplastic fluoropolymers, Blong contains no teaching whatsoever of a curing temperature. In the illustrative examples, Blong recites an extrusion temperature of 230°C. The disclosure of Blong relating to polymer extrusion clearly has no relevance to the process of the present invention, which provides for formation of a polymer layer by coating a support with a solution of the polymer in an organic solvent, then curing the coated layer.

Hartley teaches coating a fuser roll support with an organic solvent-based composition of a fluoroelastomer such as VITON A or VITON B and allowing the coated layer to air dry (column 2, line 29 to column 3, line 4; column 8, lines 9-22)). The curable fluoroelastomer compositions may optionally contain a filler or a mixture of fillers selected from a large variety of metal oxides, metal salts, metals, metal alloys, and other metal compounds (cf. column 6, line 28, to column 7, line 34).

Hartley further teaches that the curing of the fuser roll outer layer is preferably carried out, at least in part, at temperatures of at least 230°C, typically by gradually raising the temperature from about 20°C to about 230°C over a period of about 12 to 24 hours, and then holding at that temperature or slightly higher, e.g., 232°C for about 24 hours (cf. column 8, lines 26-33, emphasis added).

As already noted, Hartley teaches a layer of a cured fluoroelastomer, not a fluorocarbon thermoplastic copolymer, as provided by the present invention. On page 3 of the Office Action, it was acknowledged that Hartley fails to teach the inclusion of antimony doped tin oxide. However, as taught at page 11, line 28 to page 12, line 3 of the specification, the inclusion of antimony doped tin oxide particles is crucial for drastically lowering the curing temperature of the coated thermoplastic polymer, from 220 to 280°C to as low as room temperature..

Schlueter is relied on to supply the teaching of antimony doped tin oxide missing in Hartley. However, the Schlueter composition, like that of Hartley, includes a fluoroelastomer (column 4, line 66 to column 5, line 17; column 12, line 62 to column 13, line 14), not a fluorocarbon thermoplastic copolymer. Schleuter does not specify a curing temperature but states that the coatings were post cured, using a step heat cure, for approximately 24 hours (column 13, lines 12-14).

The disclosure of Lentz regarding curable fluoroelastomer compositions that include fillers selected from among metal oxides, metal salts, metals, and metal alloys is generally similar to those of Hartley. As with Hartley, there is no suggestion in Lentz that a metal oxide or combination of oxides can be used to enable low temperature curing of the fluoroelastomer layer. Lentz does not mention specific conditions for curing the fuser member surface layer, but Example VI describes the curing at 232 °C for 24 hours of a fluoroelastomer layer containing trace amounts of metal filler.

Fuser rolls commonly include a cushion layer, typically formed from silicone rubber, between the substrate and the release layer. As taught at page 4, lines 26-32, of the instant specification, curing of a fluoroelastomer release layer at high temperature can lead to damage to the cushion layer caused by depolymerization of the silicone rubber. The method of the present invention provides for curing a thermoplastic copolymer coating composition at a temperature of 25°C to 120°C, preferably 25°C to 50°C, more preferably 25°C, as recited in claims 1, 21, and 22, respectively. The beneficially low temperature curing is enabled by the inclusion of antimony-doped tin oxide particles in the coating composition.

The most recent Office Action again cites *In re Aller* for its holding that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” As previously noted, *In re Aller* clearly is not applicable to this case. The curing conditions employed in the method of the present invention with respect to temperature and the inclusion of antimony-doped tin oxide together with zinc oxide in a fluorocarbon thermoplastic copolymer coating composition are not disclosed or even suggested in Hartley, Schlueter, Lentz, or anywhere else in the prior art. Therefore the cited references, considered separately or in combination, fail to render obvious the applicants’ invention.

The foregoing discussion clearly distinguishes the method of the present invention, whereby fluorocarbon thermoplastic random copolymers are coated from solution onto a support, from the disclosures of fluoroelastomers in Hartley, Lentz, and Schlueter and of an extrusion process in Blong. Withdrawal of the §103(a) final rejection of claims 1-22 and allowance of this case is therefore respectfully requested.

Respectfully submitted,

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Date

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Marked-Up Copy of Specification

Page 1, lines 5-16 (Amended)

CROSS REFERENCE TO RELATED APPLICATIONS

Reference is made to commonly assigned, copending U.S. Patent Application Serial Numbers:

09/609,562, by Chen et al., filed June 30, 2000, entitled FLUOROCARBON THERMOPLASTIC RANDOM COPOLYMER COMPOSITION CURABLE AT LOW TEMPERATURES, now U.S. Patent No. [6,372,352] 6,372,833; [09/608,209] 09/608,289, by Chen et al., filed June 30, 2000, entitled METHOD OF PREPARING LOW TEMPERATURE CURE POLYMER COMPOSITION, now U.S. Patent No. 6,416,819; and 09/608,362, by Chen et al., filed June 30, 2000, entitled FUSER MEMBER WITH LOW-TEMPERATURE-CURE OVERCOAT, now U.S. Patent No. 6,355,352.